PHYSICAL MATHEMATICS SEMINAR

STRESS-DRIVEN GRAIN BOUNDARY DIFFUSION: MODELLING, ANALYSIS AND NUMERICAL METHODS

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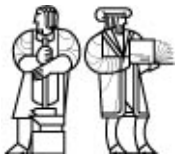
ABSTRACT:

Microchips often fail when the metallic interconnects between transistors and diodes on the chip degrade due to extremely high current densities. The physics of this process is quite interesting; it is a non-local moving interface problem involving elastic deformation and diffusion. Stress singularities can develop which make boundary conditions difficult to understand and numerical simulation difficult to implement reliably.

After describing the model, I will outline our recent proof of well-posedness, which uses techniques from semigroup theory and requires an analysis of a type of Dirichlet to Neumann map involving the equations of elasticity. I will also briefly describe my recent work on computing stable asymptotics for singularities of Agmon-Douglis-Nirenberg elliptic systems near corners and interface junctions, and show how to adjoin these singular functions to the finite element basis to accurately and efficiently resolve stress singularities without mesh refinement. If time permits, I will also show that my least squares finite element formulation for elasticity transitions gracefully to the Stokes equations in the incompressible limit, and show how to incorporate the convection term to obtain an efficient Navier-Stokes solver for low to moderate Reynolds numbers.

TUESDAY, MARCH 1, 2005
2:30 PM
Building 2, Room 338

Refreshments at 3:30 PM in Building 2, Room 349.



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